

MEASUREMENTS

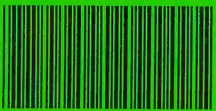
MODEL 159

COMBINATION

Megacycle Meter

OPERATING INSTRUCTIONS

MP MASTER



MA24299



MEASUREMENTS DIVISION
AUTOMATED INDUSTRIAL ELECTRONICS CORP.

10 GRANITE ST.

P. O. BOX 70

BATESBURG, S. C. 29006

(803) 532-9256



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MODEL 159 PS POWER SUPPLY

OPERATING INSTRUCTIONS

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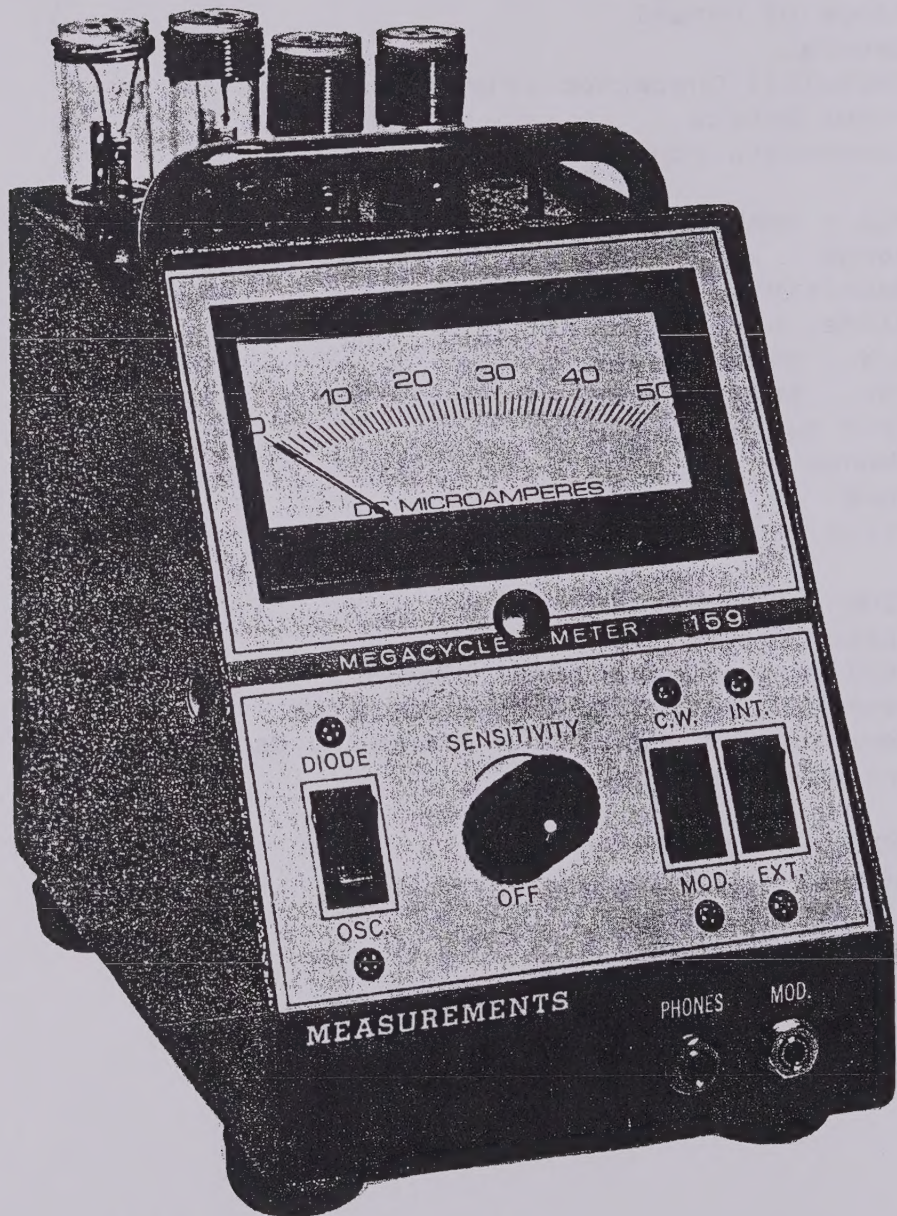
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FOREWORD

Additional information with regard to the applications and maintenance of this equipment will be available from time to time.

Users of the Model 159 series of instruments are urged to discuss their problems with us, and to suggest such modifications as might make the instruments more adaptable to their special requirements.

Whenever possible, maintenance difficulties should be reported before proceeding with actual repairs, as we are in a position to suggest the most expedient and accurate repair procedure.

Designed and manufactured to the highest standards of instrument quality, many years of trouble-free service can be expected from these instruments.

Megacycle Meters are available in the following ranges:

Model 159LF	0.1 to 4.5 Megahertz
Model 159RF	2.2 to 420 Megahertz
Model 159UHF	420 to 940 Megahertz

The Model 159PS is a common source of power for these three Megahertz Meters.

CHAPTER 1

INTRODUCTION

1. Scope of Manual

a. This manual describes the basic operation, construction and maintenance of the Model 159 Power Supply. Following the text of the manual are two appendices. Appendix I describes the recommended procedure for preparing the instrument for prolonged storage or reshipment. Appendix II contains an Identification Table of Parts, listing reference symbols, name, description and drawing number of each part required for maintenance.

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2. General

a. The Model 159 Power Supply is a compact source of power and control for the following Megacycle Meters:

Model 159LF Megacycle Meter
Model 159RF Megacycle Meter
Model 159UHF Megacycle Meter

b. The case is designed to provide safe storage for the coil sets of the Model 159RF and LF Megacycle Meters. A convenient carrying handle is provided making the unit completely portable.

3. Technical Characteristics

a. The Model 159 Power Supply provides solid state regulated direct current voltages for the various Megacycle Meters.

b. Heater voltage is supplied for the oscillator tubes of the Megacycle Meters.

c. Connection for these voltages is thru connector P2.

4. Power Source

- a. 115 volts 50 - 60 cycles AC.
- b. Power input is 30 watts.

5. Components Supplied

Quan.	Description	Dimensions			Weight
		Height	Width	Depth	
1	Model 159 Power Supply		4-3/4"	7-1/2"	6-1/2#
1	Manual of Operating Instructions				
1	Tube OA2 Installed				
1	Power Cord				

CHAPTER 2

CONTROLS

6. Power

a. Power is supplied to the Model 159 Power Supply by plugging the power cord into the 3 prong male receptacle located at the lower rear of the instrument and to the power source.

b. Voltages are supplied to the Megacycle Meter selected, by plugging its cord into the female 6 contact receptacle located to the left of the power receptacle.

c. The Power Switch S1 is combined with the Sensitivity Control. By rotating this Control clockwise the line voltage is applied to the primary of the transformer T1.

d. The Pilot Light is located within the instrument and illuminates the meter face when the line voltage is applied.

7. Sensitivity Control R12

The Sensitivity Control R12 near the center of the front panel provides a means of adjusting the grid current for on-scale readings.

8. Diode - Osc. Switch S4

a. The DIODE - OSC Switch S4 is located to the left of the Sensitivity Control.

b. In the DIODE position, the plate voltage is removed from the oscillator tube in the Megacycle Meter, changing this tube from an oscillator to a DIODE detector. In this position the instrument may be used as an absorption wavemeter.

c. In the OSC position, plate voltage is applied to the oscillator tube, either modulated or unmodulated depending upon the position of the C.W. - MOD Switch S3.

9. C.W. - Mod Switch S3

a. The C.W. - MOD Switch S3 is located to the right of the Sensitivity Control.

b. In the C.W. position the instrument may be used as a Grid-Dip Meter.

c. In the MOD position the oscillator tube may be modulated either internally or externally depending upon the position of the INT - EXT Switch S2.

10. Int - Ext Switch S2

a. The INT - EXT Switch S2 is located to the right of the C.W. - MOD Switch S3, and is effective when S3 is in the MOD position.

b. In the INT position, the oscillator tube is modulated by 120 cycles from the Power Supply.

c. In the EXT position, the oscillator tube is modulated by connecting an external source at the MOD jack J1 located on the front panel apron.

11. Grid-Current Meter M1

The grid current meter M1, indicates the relative grid current of the oscillator tube in either position of S3. In the DIODE position of S4, the meter indicates diode current.

12. Phones

The PHONES jack J2 is located on the front panel apron to the left of the MOD jack J1. Headphones may be used in either position of S3 to obtain a beat between the oscillator of unknown frequency and a Model 159 Megacycle Meter oscillator. When headphones are used, the grid current meter M1, is disconnected by the jack J2.

13. Fuse

a. The Model 159 Power Supply is protected by a 1/2 amp MDL type cartridge fuse located on the floor of the chassis to the rear of the transformer.

b. To replace the fuse, remove the four feet from the base of the Model 159 Power Supply and slide the chassis forward out of the case.

14. Pilot Light

a. The pilot light and its socket are located on a bracket attached to the rear of the front panel.

b. To replace the pilot light, slide the chassis out of the case as outlined in Paragraph 13b. Remove one screw holding the pilot light socket. Replace pilot light and re-fasten its socket.

CHAPTER 3

OPERATION

15. Installation

The Model 159 Power Supply requires no permanent installation.

16. Preliminary Operational Checks

a. Connect the selected Megacycle Meter to the Power Supply and the Power Supply to the source of line voltage.

b. Place the DIODE - OSC switch in the OSC position and the C.W. - MOD switch in the C.W. position.

c. Apply power by rotating the Sensitivity Control clockwise. The lighted meter face will indicate that power has been applied to the complete unit.

d. Adjust the SENSITIVITY Control for a meter reading about mid-scale. The grid current should stay on the scale as the tuning control located on the Megacycle Meter is varied over the band. The unit is now ready for use as a grid-dip meter.

e. Place the C.W. - MOD switch in the MOD position and the INT - EXT switch in the INT position, and adjust the SENSITIVITY Control for an on-scale meter reading. The grid-current will vary over wider limits on the MOD position than in the C.W. position. For grid-dip application the unit should be used in the C.W. position. The MOD position, however, provides a convenient means for identifying the oscillator when it is used as a signal generator.

f. With the INT - EXT switch in the INT position the oscillator is modulated by 120 cycles from the Power Supply. In the EXT position the oscillator may be modulated by an external source plugged into the MOD jack.

g. Place the DIODE - OSC switch in the DIODE position and adjust the Sensitivity Control for maximum meter reading. The Megacycle Meter may now be coupled into an active circuit and tuned for maximum meter response. Under these conditions the unit operates as an absorption wavemeter.

17. Operation as a Grid-Dip Oscillator

Adjust controls as indicated in Paragraph 16b. Couple into the passive circuit whose resonant frequency is to be determined. Tune over the frequency band until a dip occurs in the grid current indicating an absorption of oscillator energy. Back off on the coupling until a very small dip is obtained by tuning over the same general frequency range. Greater accuracy may be obtained by the use of loose coupling once the approximate frequency of the resonance has been established.

18. Operation as a Variable Frequency Oscillator

Adjust controls as indicated in Paragraph 16b. Set to desired frequency by means of the tuning knob. Couple circuit under test either inductively or capacitively.

19. Operation with Phones

a. Phones can be plugged into the PHONE jack for indication of a dip. A sharp click accompanies the dip in grid current for conventional application.

b. If indication of frequency of an oscillator is required, the phones will permit use as an oscillating detector with its resultant zero beat method of accurate frequency determination.

c. As a non-oscillating diode detector (switch S4 on DIODE) for the identification of modulated signals, oscillator harmonics, sound of parasitics of blocking character, etc., the Model 159 Megacycle Meter will be found very useful.

CHAPTER 4

MAINTENANCE INSTRUCTIONS

20. General

Preventive maintenance procedure is not recommended for the Model 159 Power Supply. Preventive maintenance is a series of operations including inspection, adjustment, lubrication, etc., recommended periodically for certain types of equipment to eliminate the possibility of unexpected interruptions in service. Critical adjustments may be disturbed by too-frequent inspection by personnel unfamiliar with the design of the Model 159 Power Supply. This may result in maladjustments causing errors in data that would be much more serious than an occasional operational failure.

21. Circuit Failure

a. Most circuit failures will be evident from indications of the grid current meter M1, and reference to the schematic diagram.

b. If failure occurs, the instrument should be checked by the procedure outlined in Paragraph 16 and if trouble other than a defective tube is indicated, the instrument should be returned to Measurements.

22. Tube Replacement

To replace the OA2 regulator tube, slide the chassis out of the case as outlined in Paragraph 13b, thereby exposing the tube underneath the chassis.

APPENDIX I

1. Storage

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere.

- (1) When the use of bag and desiccant is necessary, the instrument should be checked at 6-month intervals to determine the effectiveness of the seal.

2. Shipment

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least 3 inches of excelsior or similar packing material between the instrument and sides of the box.

- (1) For export packing, the instrument must be wrapped in waterproof paper and the seams sealed with glue or similar sealing compound before being placed in a wooden box.

APPENDIX II
TABLE OF PARTS
MODEL 159PS

<u>Symbol</u>	<u>Measurements Part Number</u>	<u>Description</u>
<u>Capacitors</u>		
C1	H-5310	Fixed; electrolytic; 2 section: 10-10 mf 450 VD
C2		
C3	H-5180	Fixed; paper dielectric; 0.5 mf 20%, 600 VDC
<u>Rectifiers</u>		
CR1		Type 2F4
CR2		Type 2F4
CR3		Type 2F4
CR4		Type 2F4
CR5		Type 2F4
<u>Lamp</u>		
E1	H-5582	Incandescent; 6 - 8 V GE #51.
<u>Knob</u>		
E2	H-7740-7	Round
<u>Fuse</u>		
F1	H-5190-4	1/2 amp type AGC
<u>Misc.</u>		
H1	H-2024	Handle; carrying
H2	H-5507	Foot, rubber
H3	H-7764	Strip; rubber trim - front
H4	H-7765	Strip, rubber trim - top
<u>Jack</u>		
J1	H-7761	Phone, plain
J2	H-7762	Phone, switched
<u>Meter</u>		
M1	H-7679	Grid current; 50 ua movement

APPENDIX II
TABLE OF PARTS
MODEL 159PS

<u>Symbol</u>	<u>Measurements Part Number</u>	<u>Description</u>
<u>Transistor</u>		
Q1		Type 2N4240
<u>Connectors</u>		
P1	H-7741	Male; recessed: 3 prong; power
P2	H-7742	Female; 6 contact
P3		Part of W1
P4		Part of W1
<u>Resistors</u>		
R1	H-3728-474	Fixed; composition; 470K ohms 10%, 1/2W
R2	H-3728-474	" " 470K ohms 10%, 1/2W
R3	H-3728-474	" " 470K ohms 10%, 1/2W
R4	H-3728-474	" " 470K ohms 10%, 1/2W
R5	H-5118	Wirewound; 1K ohms 10W
R6	H-3728-101	Fixed; composition; 100 ohms 10%, 1/2W
R7	H-3734-332	" " 3.3K ohms 10%, 2W
R8	H-3734-332	" " 3.3K ohms 10%, 2W
R9	H-3728-103	" " 10K ohms 10%, 1/2W
R10	H-3728-274	" " 270K ohms 10%, 1/2W
R11	H-3728-333	" " 33K ohms 10%, 1/2W
R12	H-7763	Variable; 10K ohms with switch
R13	H-3728-102	Fixed; composition; 1K ohms 10%, 1/2W
<u>Switches</u>		
S1		Part of R12
S2	H-7749	Rocker
S3	H-7749	Rocker
S4	H-7749	Rocker
<u>Transformer</u>		
T1	H-7689	Power
<u>Tube</u>		
V1		Regulator; OA2
<u>Cable</u>		
W1	H-7746	Power; includes P3 & P4

MEASUREMENTS

MODEL 159RF

Megacycle Meter

OPERATING INSTRUCTIONS



**MEASUREMENTS DIVISION
AUTOMATED INDUSTRIAL ELECTRONICS CORP.**

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MODEL 159RF

Megacycle Meter

OPERATING INSTRUCTIONS

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FOREWORD

Additional information with regard to the applications and maintenance of this equipment will be available from time to time. Users of the Model 159 RF Megacycle Meter are urged to discuss their problems with us and to suggest such modifications as might make the instrument more adaptable to their special requirements.

Whenever possible, maintenance difficulties should be reported to Measurements before proceeding with the actual repairs. Through our familiarity with the instrument, we are in a position to suggest the most expedient and accurate repair procedure.

Your Model 159 RF Megacycle Meter has been designed and manufactured to the highest standards of instrument quality. With reasonable care, many years of trouble-free service can be expected of it.

Megacycle meters are available in the following ranges:

Model 159 LF	0.1 to 4.5 Megacycles.
Model 159 RF	2.2 to 420 Megacycles.
Model 159 UHF	420 to 940 Megacycles.

The Model 159 Power Supply is a common source of power for these three Megacycle Meters.

Engineering Department

MEASUREMENTS

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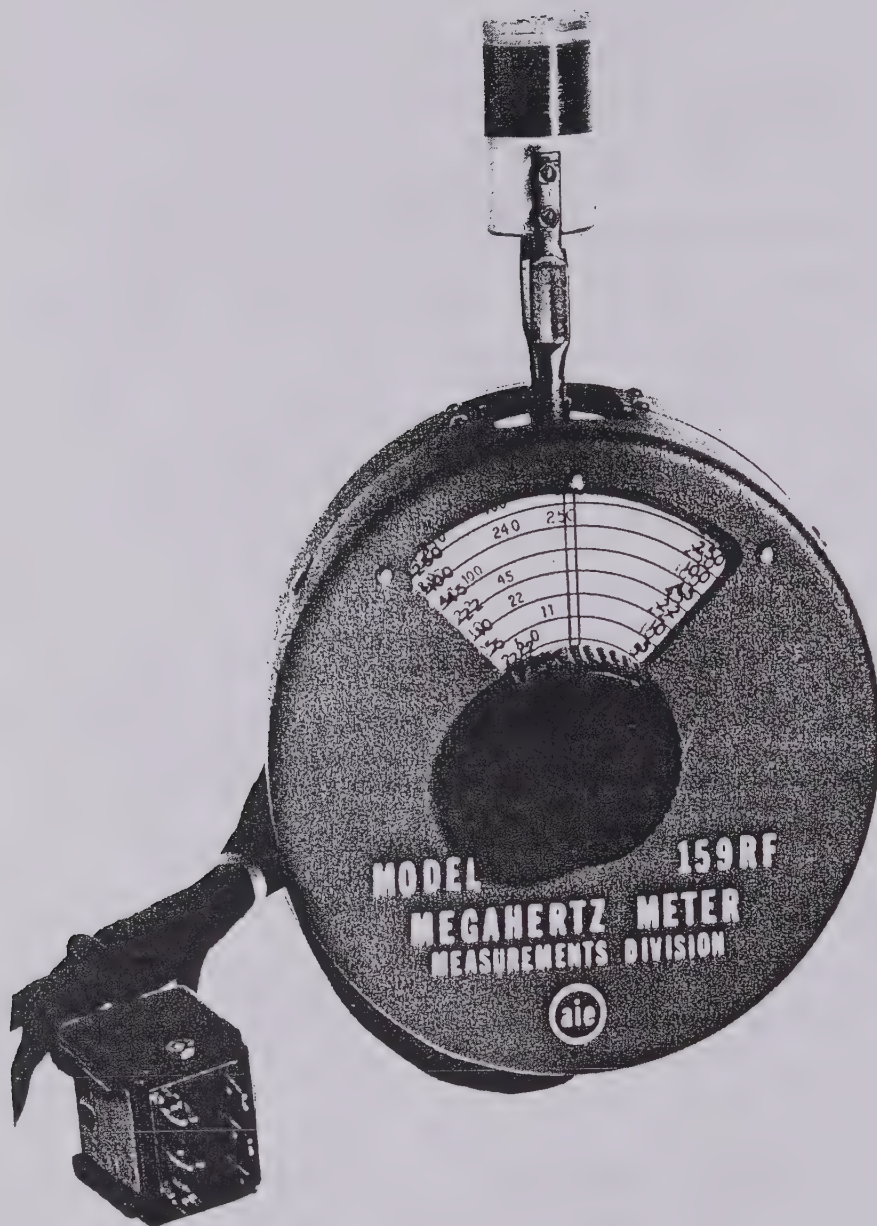


FIGURE 1. MODEL 159 RF MEGACYCLE METER

CHAPTER 1

INTRODUCTION

1. SCOPE OF MANUAL

a. This manual describes the basic operation, construction and maintenance of the Model 159 RF Megacycle Meter. Following the text of the manual are two appendices. Appendix I describing the recommended procedure for preparing the instrument for prolonged storage or re-shipment. Appendix II contains an Identification Table of Parts, listing reference symbols, name and description, and drawing number of each part required for maintenance.

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2. GENERAL

a. The Model 159 RF Megacycle Meter is a compact oscillator covering a frequency range of 2.2 to 420 megacycles and may be used as follows:

1. As a grid-dip meter.
2. As a variable frequency oscillator, either modulated or unmodulated.
3. As an absorption wavemeter.
4. As an oscillating detector, or as a tuned diode detector.

b. Power for the Model 159 RF Megacycle Meter must be supplied from a Model 159 Power Supply.

c. The hook on the bottom of the case fits the slot located on the top right hand edge of the power supply.

d. The frequency tuning knob for the Model 159 RF Megacycle Meter is located on the front of the Meter. All other functional controls are located on the front panel of the Model 159 Power Supply. REFER TO THE MODEL 159 POWER SUPPLY MANUAL FOR OPERATION OF THESE CONTROLS.

3. TECHNICAL CHARACTERISTICS

a. FREQUENCY CHARACTERISTICS:

1. Continuously variable from 2.2 to 420 megacycles with seven plug-in coils.

2. Ranges:	2.2 - 5.4 megacycles
	5 - 11 megacycles
	9.5 - 22.5 megacycles
	20 - 46 megacycles
	42 - 102 megacycles
	95 - 250 megacycles
	200 - 420 megacycles

b. FREQUENCY CALIBRATION:

1. Each unit is individually calibrated to better than 2% accuracy. However, the accuracy obtainable under operating conditions depends on the technique of the user. This technique is described in Paragraph

2. The calibration is essentially linear over the entire frequency range.

c. MODULATION:

1. Internally from Power Supply, 120 cycles, or externally as selected.

d. POWER SOURCE:

1. Model 159 Power Supply.

4. COMPONENTS SUPPLIED

Quan.	Description	Dimensions		Weight
		Diameter	Depth	
1	Model 159 RF Megacycle Meter	3-3/4"	2"	1#
1	Model 159 RF Set of Coils			
1	Manual of Operating Instructions			
1	Tube, Type 955 Installed			

CHAPTER 2

OPERATING INSTRUCTIONS

5. INSTALLATION

a. The Model 159 RF Megacycle Meter is completely portable and requires no permanent installation.

6. PRELIMINARY OPERATIONAL CHECKS

a. Select a coil from the set of coils and plug it into the socket at the top of the Model 159 RF Megacycle Meter.

b. Insert the six-prong plug at the end of the flexible cable of the Model 159 RF Megacycle Meter into the six-prong receptacle at the rear of the Model 159 Power Supply.

c. Insert the 3 wire power cord into the 3 prong receptacle at the rear of the Model 159 Power Supply and to a power source of 115 V 50-60 cycles AC.

d. Switch power on by rotating the Sensitivity Control in a clock-wise direction. The lighted meter face will indicate that the power is applied. Allow one minute for the tube to warm up. Adjust the Sensitivity Control for an on-scale reading.

e. A regulator tube is located in the Model 159 Power Supply and should be ignited for proper operation.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

7. GENERAL

a. Preventive maintenance procedure is not recommended for the Model 159 RF Megacycle Meter. Preventive maintenance is a series of operations including inspection, adjustment, lubrication, tec., recommended periodically for certain types of equipment to eliminate the possibility of unexpected interruptions in service. Critical adjustments may be disturbed by too-frequent inspection by personnel unfamiliar with the design of the Model 159 RF Megacycle Meter. This may result in maladjustments causing errors in data that would be much more serious than an occasional operational failure.

8. CIRCUIT FAILURE

a. Most circuit failures will be evident from indications of the grid current meter M1, and reference to the schematic diagram. Failure to oscillate may result if the unit is dropped.

b. If failure occurs, the instrument should be checked by the procedure outlined in Paragraph 6, and if trouble other than a defective tube is indicated, the instrument should be returned to Measurements.

c. If the seal on the instrument is broken without the permission of Measurements, the one-year guarantee will be void.

9. TUBE REPLACEMENT

a. To replace the 955 tube remove the tuning knob and the three screws holding the side. Lift off the cover exposing the tuning dial, etc. Remove the tuning dial, taking care not to touch or smear the calibration numbers. Place the dial face up and cover it while it is out of the unit.

The cathode clip of the 955 must be slipped loose radially first. The 955 can then be removed by a slight twisting, counter-clockwise motion.

Insert the new 955 and twist slightly into place, taking care to see that all four pins line up properly. DO NOT FORCE into place. Slide the cathode (center pin) contact clip into place. Replace the tuning dial and its three mounting screws. Replace the cover and knob and leave the three cover screws, slightly loose, so that it will be possible to rotate the cover.

Turn the tuning knob as far as it will go clockwise and rotate the cover so that the fiducial falls over the long end mark on the dial. Tighten the three case screws.

10. RECOMMENDED EQUIPMENT

a. The only test equipment required is that which is necessary for checking frequency calibration. A Model 111-B Crystal Calibrator is recommended for this purpose.

CHAPTER 4

TECHNICAL SERVICE

11. SCOPE

The purpose of this chapter is to acquaint operating and maintenance personnel with the theory of operation of the various circuits in the Model 159 RF Megacycle Meter.

12. CONDENSED THEORY OF OPERATION

a. V3 is connected in a Colpitts type oscillator circuit with the inter-electrode capacitance of the tube providing the feedback.

b. The oscillator is tuned by means of a split-stator type capacitor, C5 and C6.

c. The tank inductance is either of the coils L2, L3, L4, L5, L6, L7 or L8 as selected. The oscillator is coupled to external circuits to be tested by means of these coils.

13. SELECTION OF COILS

Frequency ranges are marked on each coil except for the two highest frequency coils. Frequency limits of the corresponding scales are marked on the oscillator unit. After insertion of the desired coil, it is advisable to set the tuning knob to mid-scale, and then adjust the sensitivity knob to approximately 50 on the grid current meter. Normal variation of the grid current with tuning will then usually remain on scale over the entire range of that particular coil. (Note: on some low frequency coils it may be necessary to readjust the sensitivity knob at the extremes of the tuning range.)

14. COUPLING

Either inductive or capacitive coupling of the Model 159 RF can be made to circuit under test. For most tuned circuits it may be more convenient to utilize inductive coupling. Maximum coupling (and largest dip in grid current) will result with the axis of the oscillator coil at right angles to the current flow.

Some types of tuned circuits are well shielded magnetically, so that it is difficult to utilize inductive coupling. For these applications, it may be necessary to use a one or two micromicrofarad coupling capacitor. This can be obtained by twisting together an inch or two of hook-up wire. This capacitance should be kept as small as possible, since it will affect the frequency calibration accuracy of the Model 159 RF. Fortunately it is not usually required that loaded (low "Q") circuits be located as accurately in frequency as higher "Q" ones.

Completely enclosed resonant cavities usually have some type of coupling loop which can be utilized with the aid of an auxiliary external transmission line and coupling loop as a link coupling arrangement for coupling inductive to the Model 159 RF.

15. SPECIAL MEASUREMENTS

a. It is possible to measure the resonant frequency of a quartz crystal by holding it close to the oscillator coil. Loose coupling is required for accurate frequency determination. Since the "Q" of the crystal is high, it is desirable to use head phones to determine the grid dip with its accompanying "click" in the phones.

15. Special Measurements - Continued

b. The Model 159 RF can be used for measuring capacitance by connecting the capacitor to a coil of known inductance. Alternatively, the unknown capacitor may be connected in parallel with a calibrated variable capacitor connected to a coil and tuned to resonance at a given frequency. The change in capacitance required to restore resonance is equal to the unknown capacitance.

c. The inductance of inductors can be determined by connecting them to a known fixed capacitor, or to a calibrated variable capacitor, and measuring the resonant frequency with the Model 159 RF. Reference to standard Reactance-Frequency graphs will facilitate the determination of the value of the known inductance.

16. FREQUENCY ACCURACY OF MEASUREMENT

The greatest frequency accuracy of the Model 159 RF can be obtained by proper use of the instrument. In general, if the coupling to the circuit under test is too close, the oscillator will be detuned or "pulled". To obtain the greatest accuracy, couple the Model 159 RF tightly to the circuit under test for the initial search of a dip in grid current or zero beat. After the initial indication is obtained, decrease the coupling as much as practicable while still obtaining an indication.

APPENDIX I

1. STORAGE

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere.

- (1) When the use of bag and desiccant is necessary, the instrument should be checked at 6-month intervals to determine the effectiveness of the seal.

2. SHIPMENT

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least 3 inches of excelsior or similar packing material between the instrument and sides of the box.

- (1) For export packing, the instrument must be wrapped in waterproof paper and the seams sealed with glue or similar sealing compound before being placed in a wooden box.

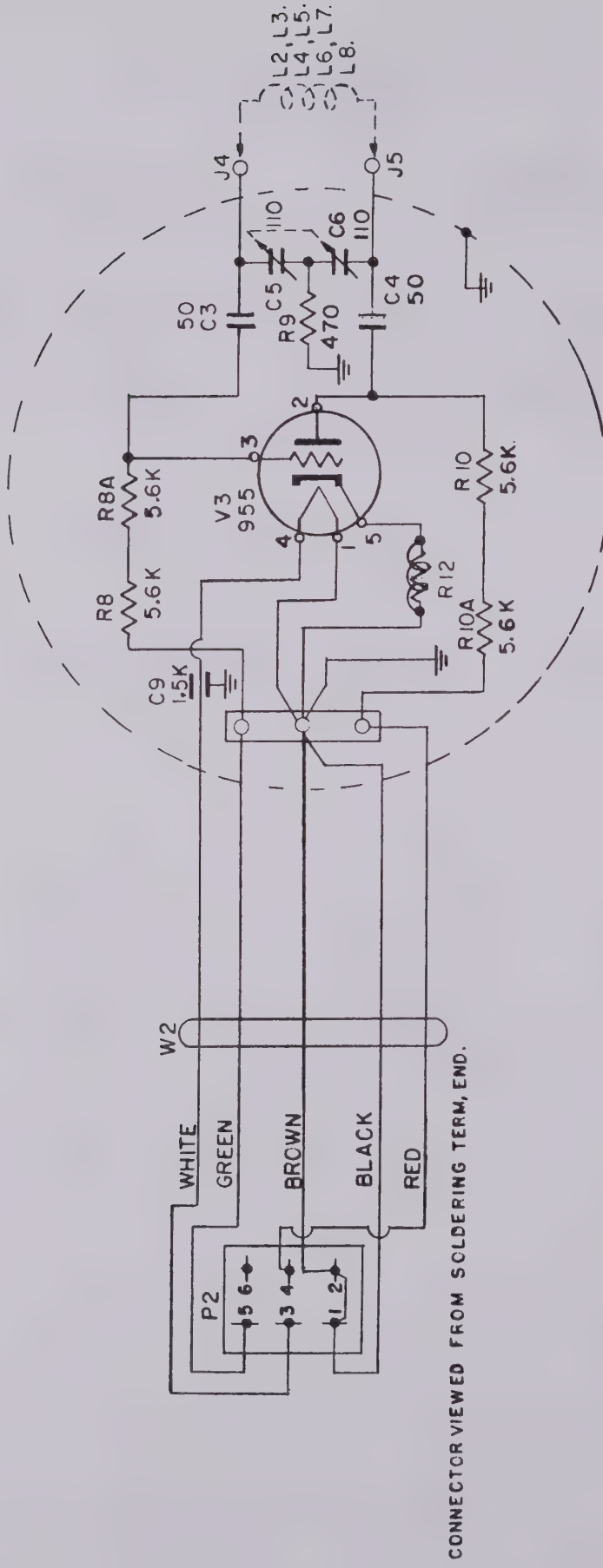
APPENDIX II
TABLE OF PARTS
MODEL 159 RF

<u>Symbol</u>	<u>Measurements</u> <u>Part Number</u>	<u>Description</u>
<u>Capacitors</u>		
C3	*	Fixed; mica 50 μ mf. Part of C5.
C4	*	" " 50 μ mf. Part of C5.
C5)	HM-403	Variable, air dielectric; two sections
C6)		10 to 110 μ mf each.
C9	H-6619-3	Fixed; ceramic 1500 μ mf GMV.
<u>Knob</u>		
E2	H-7740-5	Round.
<u>Foot</u>		
H1	H-7767	Rubber.
<u>Sockets</u>		
J4	*	Part of C5.
J5	*	Part of C5.
<u>Coils</u>		
L2	H-3190-1	RF; 2.2 - 5 Mc.
L3	H-3190-2	RF; 5 - 10 Mc.
L4	H-3190-3	RF; 10 - 22 Mc.
L5	H-3190-4	RF; 22 - 45 Mc.
L6	H-3190-5	RF; 45 - 100 Mc.
L7	H-1973	RF; 100 - 250 Mc.
L8	H-1974	RF; 200 - 400 Mc.
L9	HM-463	Coil Set; comprises L2, L3, L4, L5, L6, L7 & L8 mounted in coil rack.
<u>Connector</u>		
P2	H-7743	Plug; male 6 prong.

* Not recommended for field replacement.

APPENDIX II
TABLE OF PARTS
MODEL 159 RF

<u>Symbol</u>	<u>Measurements Part Number</u>	<u>Description</u>
<u>Resistors</u>		
R8	H-3728-562	Fixed; composition; 5.6 K ohms 10%, 1/2 W.
R8A	H-3728-562	" " 5.6 K ohms 10%, 1/2 W.
R9	H-3728-471	" " 470 ohms 10%, 1/2 W.
R10	H-3728-562	" " 5.6 K ohms 10%, 1/2 W.
R10A	H-3728-562	" " 5.6 K ohms 10%, 1/2 W.
R12	H-1980	Quock, resistor and coil.
<u>Tube</u>		
V3		Electron; triode; type 955.
<u>Cable</u>		
W2	H-886	Flexible; 5 conductor.
	H-7766	Flexible; 5 conductor. Includes P2.



SCHEMATIC DIAGRAM
MODEL 159 RF

UNLESS OTHERWISE SPECIFIED

ALL RESISTORS 0.5 WATT,
ALL CAPACITORS IN MMF.

MEASUREMENTS

MODEL 159LF
Megacycle Meter

OPERATING INSTRUCTIONS



MEASUREMENTS DIVISION
AUTOMATED INDUSTRIAL ELECTRONICS CORP.

10 GRANITE ST. P. O. BOX 70 BATESBURG, S. C. 29006 (803) 532-9256



**MODEL 159 LF
MEGACYCLE METER
OPERATING INSTRUCTIONS**

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**MEASUREMENTS DIVISION
AUTOMATED INDUSTRIAL ELECTRONICS CORP.**

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FOREWORD

Additional information with regard to the applications and maintenance of this equipment will be available from time to time. Users of the Model 159 LF Megacycle Meter are urged to discuss their problems with us and to suggest such modifications as might make the instrument more adaptable to their special requirements.

Whenever possible, maintenance difficulties should be reported to AUTOMATED INDUSTRIAL ELECTRONICS CORPORATION before proceeding with the actual repairs. Through our familiarity with the instrument, we are in a position to suggest the most expedient and accurate repair procedure.

Your Model 159 LF Megacycle Meter has been designed and manufactured to the highest standards of instrument quality. With reasonable care, many years of trouble-free service can be expected of it.

Megacycle meters are available in the following ranges:

Model 159 LF	0.1 to 4.5 Megacycles
Model 159 RF	2.2 to 420 Megacycles
Model 159 UHF	420 to 940 Megacycles

The Model 159 Power Supply is a common source of power for these three Megacycle Meters.

Engineering Department

MEASUREMENTS

AUTOMATED INDUSTRIAL ELECTRONICS CORPORATION
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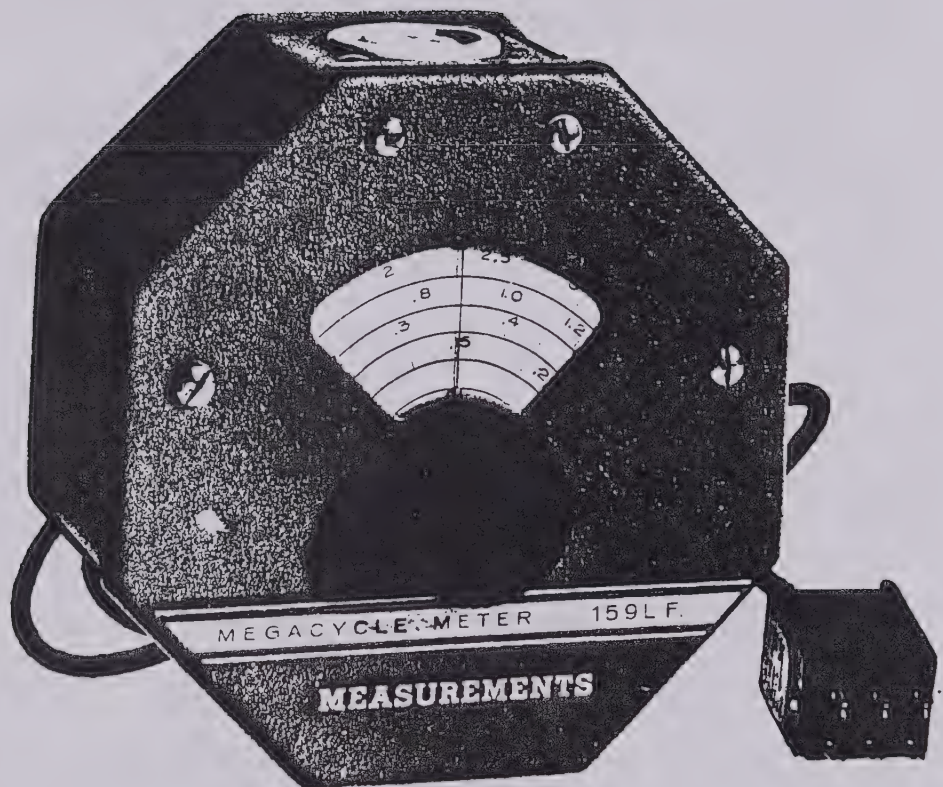


Figure 1. Model 159 LF Megacycle Meter

CHAPTER 1

INTRODUCTION

1. SCOPE OF MANUAL

a. This manual describes the basic operation, construction and maintenance of the Model 159 LF Megacycle Meter. Following the text of the manual are two appendices. Appendix I describing the recommended procedure for preparing the instrument for prolonged storage or reshipment. Appendix II contains an Identification Table of Parts, listing reference symbols, name and description, and drawing number of each part required for maintenance.

b. This book contains copyrighted material. Reproduction in whole or in part is prohibited except by permission of Measurements.

2. GENERAL

a. The Model 159 LF Megacycle Meter is a compact oscillator covering a frequency range of .1 to 4.5 megacycles and may be used as follows:

- 1) As a grid-dip meter
- 2) As a variable frequency oscillator, either modulated or unmodulated
- 3) As an absorption wavemeter
- 4) As an oscillating detector, or as a tuned diode detector

b. Power for the Model 159 LF Megacycle Meter must be supplied from a Model 159 Power Supply.

c. The octagonal case is functionally designed to provide a maximum of convenience in positioning the instrument. The hook on the bottom of its case fits the slot located on the top right hand edge of the power supply.

d. The frequency tuning knob for the Model 159 LF Megacycle Meter is located on the front of the Meter. All other functional controls are located on the front panel of the Model 159 Power Supply. REFER TO THE MODEL 159 POWER SUPPLY MANUAL FOR OPERATION OF THESE CONTROLS.

3. TECHNICAL CHARACTERISTICS

a. FREQUENCY CHARACTERISTICS:

1) Continuously variable from 100 kilocycles to 4.5 megacycles with four plug-in coils.

2) Ranges: .1 to .25 megacycles
 .25 to .55 megacycles
 .55 to 1.5 megacycles
 1.5 to 4.5 megacycles

3) There is also available as an accessory at additional cost a matching coil in the following range:

.05 to .1 megacycles

b. FREQUENCY CALIBRATION :

1) Each unit is individually calibrated to better than 2% accuracy. However, the accuracy obtainable under operating conditions depends on the technique of the user. This technique is described in paragraph 16.

2) The calibration is essentially linear over the entire frequency range.

c. MODULATION:

1) Internally from Power Supply, 120 cycles, or externally as selected.

d. POWER SOURCE:

1) Model 159 Power Supply

4. COMPONENTS SUPPLIED

Qty.	Description	Dimensions			
		Height	Width	Depth	Weight
1	Model 159LF Megacycle Meter	3-5/8"	4-5/8"	4-5/8"	1#
1	Model 159LF Set of Four Coils				
1	Manual of Operating Instructions				
1	Tube, Type 6C4 Installed				

CHAPTER 2

OPERATING INSTRUCTIONS

5. INSTALLATION

a. The Model 159 LF Megacycle Meter is completely portable and requires no permanent installation.

6. PRELIMINARY OPERATIONAL CHECKS

a. Select a coil from the set of coils and plug it into the socket at the top of the Model 159 LF Megacycle Meter.

b. Insert the six-prong plug at the end of the flexible cable of the Model 159 LF Megacycle Meter into the six-prong receptacle at the rear of the Model 159 Power Supply.

c. Insert the 3 wire power cord into the 3 prong receptacle at the rear of the Model 159 Power Supply and to a power source of 115V 50-60 cycles AC.

d. Switch power on by rotating the Sensitivity Control in a clockwise direction. The lighted meter face will indicate that the power is applied. Allow one minute for the tube to warm up. Adjust the Sensitivity Control for an on-scale reading.

e. A regulator tube is located in the Model 159 Power Supply and should be ignited for proper operation.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

7. GENERAL

a. Preventive maintenance procedure is not recommended for the Model 159 LF Megacycle Meter. Preventive maintenance is a series of operations including inspection, adjustment, lubrication, etc., recommended periodically for certain types of equipment to eliminate the possibility of unexpected interruptions in service. Critical adjustments may be disturbed by too-frequent inspection by personnel unfamiliar with the design of the Model 159 LF Megacycle Meter. This may result in maladjustments causing errors in data that would be much more serious than an occasional operational failure.

8. CIRCUIT FAILURE

a. Most circuit failures will be evident from indications of the grid current meter M1, and reference to the schematic diagram. Failure to oscillate may result if the unit is dropped.

b. If failure occurs, the instrument should be checked by the procedure outlined in paragraph 6, and if trouble other than a defective tube is indicated, the instrument should be returned to Measurements.

9. TUBE REPLACEMENT

a. To replace the 6C4 tube, remove the tuning knob, remove the screws located on the right and left edges of the top cover and remove four screws holding the side. Do not disturb the two screws above the fiducial. Lift the cover off. Further disassembly is not recommended.

10. RECOMMENDED EQUIPMENT

a. The only test equipment required is that which is necessary for checking frequency calibration. A high-quality Signal Generator such as Measurements Models 65-B or 82 may be employed to check the frequency calibration of the Model 159 LF when required.

CHAPTER 4

TECHNICAL SERVICE

11. SCOPE

The purpose of this chapter is to acquaint operating and maintenance personnel with the theory of operation of the various circuits in the Model 159 LF Megacycle Meter.

12. CONDENSED THEORY OF OPERATION

a. The tube V201 (6C4) is connected in a tuned-plate oscillator circuit with a grid coil providing the feedback.

b. The plate of the oscillator tube is tapped down on the plate coil in order to minimize the effect of tube loading and change in frequency calibration with change in tube.

c. The plug-in coils are carefully designed to provide good coupling with a minimum of grid-current variation as the oscillator is tuned over each band.

d. The oscillator is tuned by means of the capacitor C203.

13. INDUCTIVE COUPLING

a. Inductive coupling is recommended for coupling to a coil in a resonant circuit. The self-resonant frequency of a coil may also be obtained by coupling it inductively to the Megacycle Meter.

b. The proper relative orientation of the coil in the Megacycle Meter to the coil under test is easily determined experimentally. The plug-in coil forms are transparent so that the coupling positions for maximum and minimum coupling may be determined visually.

c. It is possible to couple inductively to toroidal coils by orienting them properly with respect to the oscillator coil. In most cases, the plane of the toroidal core should be at right angles to the plane of the oscillator coil.

d. If a coil is so mounted that the oscillator head may not be brought close to it, a link circuit may be used to couple to the coil. The link circuit may be made of a one- or two-turn coil connected to each end of a piece of power cord, or twin-conductor transmission line. One of these coils is coupled to the coil under test while the other is coupled to the oscillator coil.

14. CAPACITIVE COUPLING

a. A 4.7 micromicrofarad capacitor, C206, is connected to a phone-tip jack located to the left of the coil to permit capacitive coupling to test circuits.

b. A lead plugged into the phone-tip jack may be connected directly to a high-impedance point on a resonant circuit for the usual grid-dip application. In general, the 4.7 micro-microfarad capacitor will provide tighter coupling than is desirable for the accurate determination of the frequency of the resonant circuit. Looser coupling may

be obtained by forming a small capacitor in the coupling lead by twisting two insulated sections of the lead together to form a small capacitor in series with the lead. This auxiliary capacitor should be kept as small as possible for accurate frequency determinations.

c. With capacitive coupling, it is possible to couple to resonant circuits which are completely enclosed in a shield such as intermediate-frequency coils, shielded toroidal coils, etc.

15. SPECIAL MEASUREMENTS

a. It is possible to measure the resonant frequency of a quartz crystal by holding it close to the oscillator coil, or by coupling it capacitively to the phone-tip jack. In either case, loose coupling is required for accurate frequency determination. Since the Q of the crystal is high, it is desirable to use head phones to determine the grid dip with its accompanying "click" in the phones.

b. The Model 159LF can be used for measuring capacitance by connecting the capacitor to a coil of known inductance. Alternatively, the unknown capacitor may be connected in parallel with a calibrated variable capacitor connected to a coil and tuned to resonance at a given frequency. The change in capacitance required to restore resonance is equal to the unknown capacitance.

c. The inductance of inductors can be determined by connecting them to a known fixed capacitor, or to a calibrated variable capacitor, and measuring the resonant frequency with the Model 159 LF. Reference to standard Reactance-Frequency graphs will facilitate the determination of the value of the unknown inductance.

16. FREQUENCY ACCURACY OF MEASUREMENT

The greatest frequency accuracy of the Model 159 LF can be obtained by proper use of the instrument. In general, if the coupling to the circuit under test is too close, the oscillator will be detuned or "pulled". To obtain the greatest accuracy, couple the Model 159 LF tightly to the circuit under test for the initial search of a dip in grid current or zero beat. After the initial indication is obtained, decrease the coupling as much as practicable while still obtaining an indication.

APPENDIX I

1. STORAGE

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere.

1) When the use of bag and desiccant is necessary, the instrument should be checked at six-month intervals to determine the effectiveness of the seal.

2. SHIPMENT

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least three inches of excelsior or similar packing material between the instrument and sides of the box.

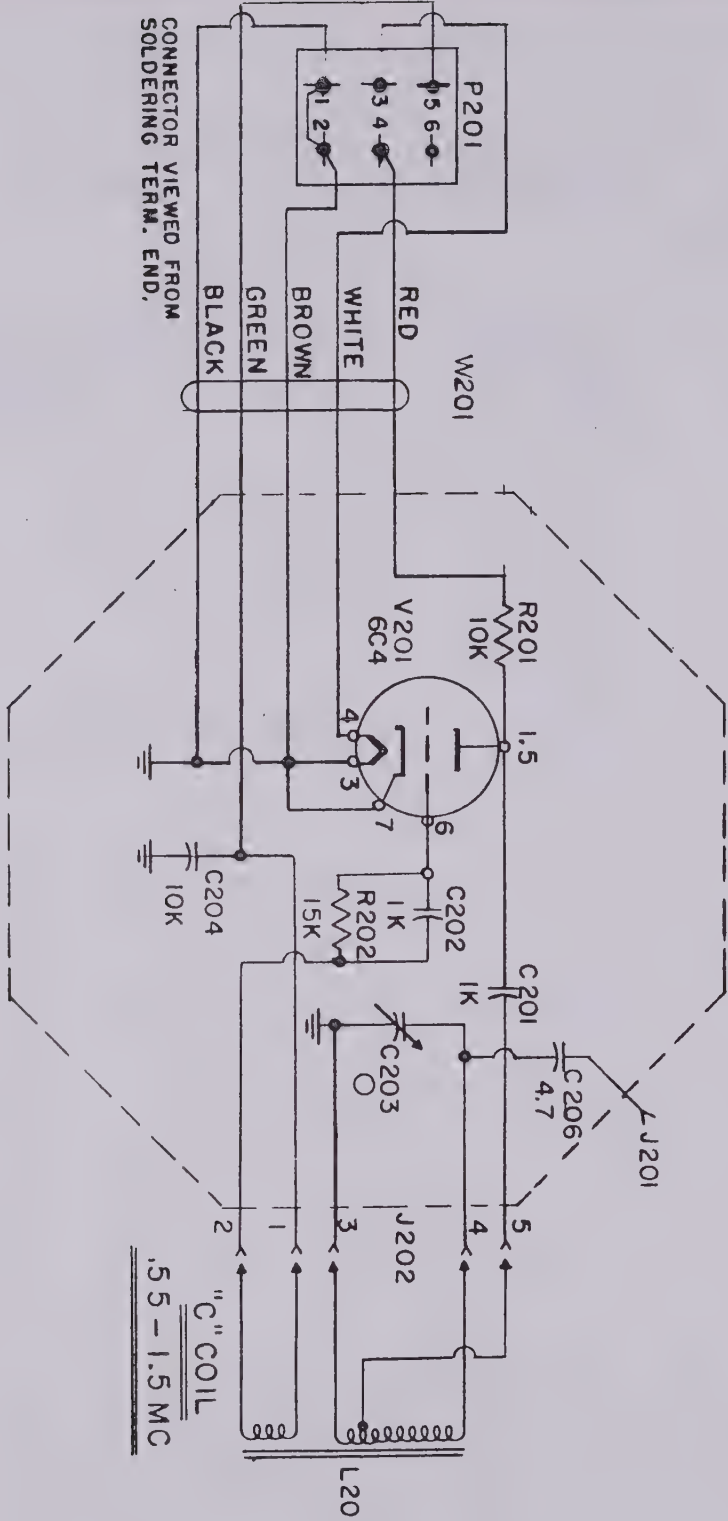
1) For export packing, the instrument must be wrapped in waterproof paper and the seams sealed with glue or similar sealing compound before being placed in a wooden box.

APPENDIX II

TABLE OF PARTS MODEL 159LF

<u>Symbol</u>	<u>Measurements Part Number</u>	<u>Description</u>
<u>Capacitors</u>		
C201		Fixed; ceramic .01 mf GMV
C202		" " .01 mf GMV
C203	H-4915	Variable, air 12 to 480 mmf
C204		Fixed; ceramic .01 mf GMV
C205		" " 2.2 mmf NPO
C206		" " 4.7 mmf NPO
<u>Knob</u>		
E201	H-7740-5	Round
<u>Foot</u>		
H201	H-5507	Rubber
<u>Jack</u>		
J201	H-5506	Tip; Black plastic
<u>Socket</u>		
J202	H-5505	Steatite; 5 prong
<u>Coils</u>		
L201	H-4927	RF: or Part of H-4923
L202	H-4928	RF: or Part of H-4924
L203	H-4929	RF: or Part of H-4925
L204	H-4930	RF: or Part of H-4926
<u>Connector</u>		
P201	H-7743	Plug; Male 6 prong

<u>Symbol</u>	<u>Measurements</u> <u>Part Number</u>	<u>Description</u>
<u>Resistors</u>		
R201	H-3728-103	Fixed; composition; 10 K ohms 10% 1/2W
R202	H-3728-153	Fixed; composition; 15 K ohms 10% 1/2W
R203	H-3727-244	" " 240 K ohms 10% 1/2W
R204	H-3728-102	" " 1 K ohms 10% 1/2W
<u>Tube</u>		
V201		Electrode, 6C4
<u>Cable</u>		
W201	H-886	Flexible; 5 conductor
	H-7715	Flexible; 5 conductor. Includes P201.
<u>Socket</u>		
XV201	H-5504	Tube; 7 contact miniature
<u>Accessory</u>		
	HM-503	Plug-in Coil. .05 - .1 mc.



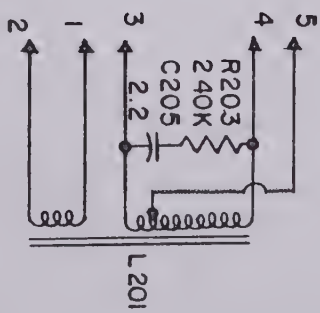
CONNECTOR VIEWED FROM
SOLDERING TERM. END.

SCHEMATIC DIAGRAM MODEL 159 LF

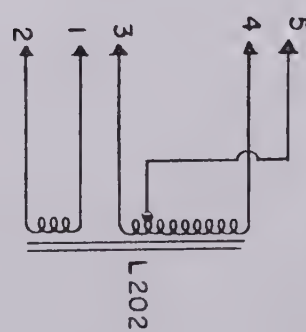
UNLESS OTHERWISE SPECIFIED

ALL RESISTORS 0.5 WATT.
ALL CAPACITORS IN MMF.

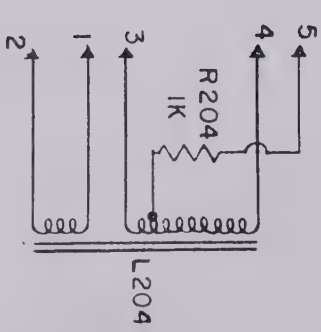
O=FRONT PANEL CONTROL.



"A" COIL, .1-.25 MC



"B" COIL, .25-.55 MC



"D" COIL, 1.5-4.5 MC

MEASUREMENTS

MODEL 159UHF
Megacycle Meter

OPERATING INSTRUCTIONS



MEASUREMENTS DIVISION
AUTOMATED INDUSTRIAL ELECTRONICS CORP.

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**MODEL 159 UHF
MEGACYCLE METER
OPERATING INSTRUCTIONS**

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FOREWORD

Additional information with regard to the applications and maintenance of this equipment will be available from time to time. Users of the Model 159 UHF Megacycle Meter are urged to discuss their problems with us and to suggest such modifications as might make the instrument more adaptable to their special requirements.

Whenever possible, maintenance difficulties should be reported to Measurements before proceeding with the actual repairs. Through our familiarity with the instrument, we are in a position to suggest the most expedient and accurate repair procedure.

Your Model 159 UHF Megacycle Meter has been designed and manufactured to the highest standards of instrument quality. With reasonable care, many years of trouble-free service can be expected of it.

Megacycle meters are available in the following ranges:

Model 159 LF	0.1 to 4.5 Megacycles
Model 159 RF	2.2 to 420 Megacycles
Model 159 UHF	420 to 940 Megacycles

The Model 159 Power Supply is a common source of power for these three Megacycle Meters.

Engineering Department

MEASUREMENTS

AUTOMATED INDUSTRIAL ELECTRONICS CORPORATION
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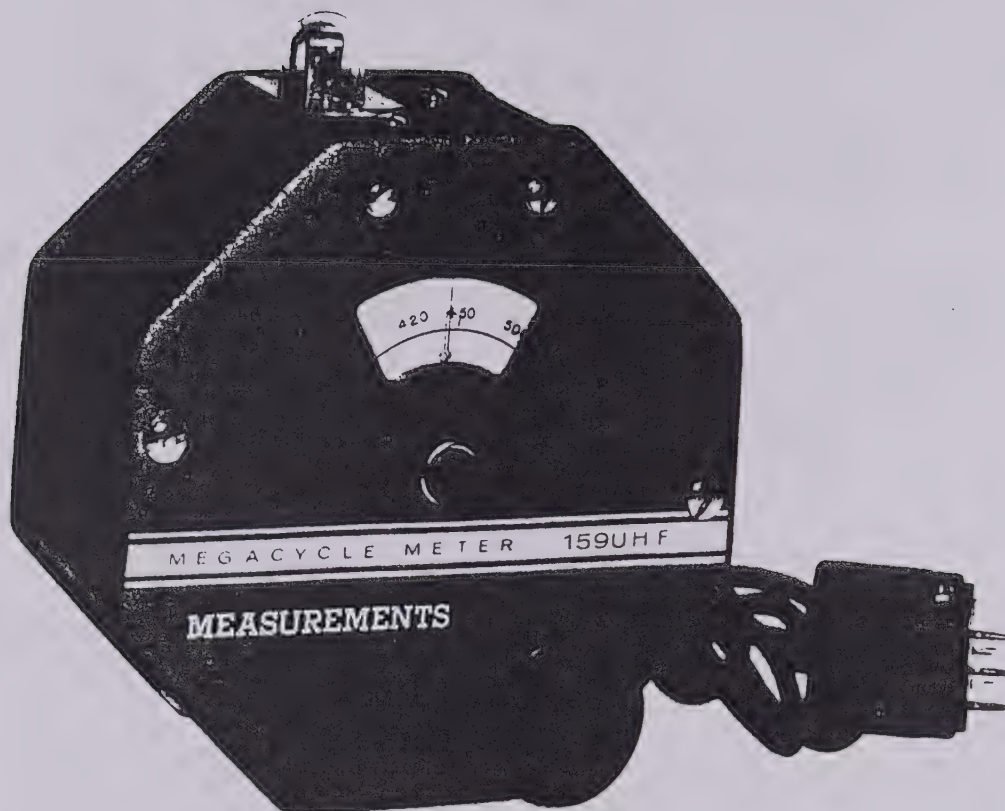


Figure 1. Model 159 UHF Megacycle Meter

CHAPTER 1

INTRODUCTION

1. SCOPE OF MANUAL

a. This manual describes the basic operation, construction and maintenance of the Model 159 UHF Megacycle Meter. Following the text of the manual are two appendices. Appendix I describes the recommended procedure for preparing the instrument for prolonged storage or reshipment. Appendix II contains an Identification Table of Parts, listing reference symbols, name and description, and drawing number of each part required for maintenance.

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2. GENERAL

a. The Model 159 UHF Megacycle Meter is a compact oscillator covering a frequency range of 420 to 940 megacycles and may be used as follows:

1. As a grid-dip meter.
2. As a variable frequency oscillator, either modulated or unmodulated.
3. As an absorption wavemeter.
4. As an oscillating detector, or as a tuned diode detector.

b. Power for the Model 159 UHF Megacycle Meter must be supplied from a Model 159 Power Supply.

c. The octagonal case is functionally designed to provide a maximum of convenience in positioning the instrument. The hook on the bottom of its case fits the slot located on the top right hand edge of the power supply.

d. The frequency tuning knob for the Model 159 UHF Megacycle Meter is located on the front of the Meter. All other functional controls are located on the front panel of the Model 159 Power Supply. REFER TO THE MODEL 159 POWER SUPPLY MANUAL FOR OPERATION OF THESE CONTROLS.

e. **IMPORTANT:** Read Paragraph 14 entitled GRID-DIP PHENOMENA IN THE UHF BAND before using the Model 159 UHF Megacycle Meter.

3. TECHNICAL CHARACTERISTICS

a. FREQUENCY CHARACTERISTICS:

1. Continuously variable from 420 to 940 megacycles in one range.

b. FREQUENCY CALIBRATION:

1. Each unit is individually calibrated every 10 megacycles to better than 2% accuracy. However, the accuracy obtainable under operating conditions depends on the technique of the user. This technique is described in Paragraph 13.

2. The calibration is virtually linear over the entire frequency range.

c. MODULATION:

1. Internally from Power Supply, 120 cycles, or externally as selected.

d. POWER SOURCE:

1. Model 159 Power Supply.

4. COMPONENTS SUPPLIED

Quan.	Description	Height	Dimensions		Weight
			Width	Depth	
1	Model 159 UHF Megacycle Meter	3-5/8"	4-5/8"	4-5/8"	1#
1	Manual of Operating Instruction				
1	Tube, 6AF4A Installed				

CHAPTER 2

OPERATING INSTRUCTIONS

5. INSTALLATION

a. The Model 159 UHF Megacycle Meter is completely portable and requires no permanent installation.

6. PRELIMINARY OPERATIONAL CHECKS

a. Insert the six-prong plug at the end of the flexible cable of the Model 159 UHF Megacycle Meter into the six-prong receptacle at the rear of the Model 159 Power Supply.

b. Insert the 3 wire power cord into the 3 prong receptacle at the rear of the Model 159 Power Supply and to a power source of 115 V 50-60 cycles AC.

c. Switch power on by rotating the Sensitivity Control in a clockwise direction. The lighted meter face will indicate that the power is applied. Allow one minute for the tube to warm up. Adjust the Sensitivity Control for an on-scale reading.

d. A regulator tube is located in the Model 159 Power Supply and should be ignited for proper operation.

CHAPTER 3

MAINTENANCE INSTRUCTIONS

7. GENERAL

a. Preventive maintenance procedure is not recommended for the Model 159 UHF Megacycle Meter. Preventive maintenance is a series of operations including inspection, adjustment, lubrication, etc., recommended periodically for certain types of equipment to eliminate the possibility of unexpected interruptions in service. Critical adjustments may be disturbed by too-frequent inspection by personnel unfamiliar with the design of the Model 159 UHF Megacycle Meter. This may result in maladjustments causing errors in data that would be much more serious than an occasional operational failure.

8. CIRCUIT FAILURE

a. Most circuit failures will be evident from indications of the grid current meter M1, and reference to the schematic diagram. Failure to oscillate may result if the unit is dropped.

b. If failure occurs, the instrument should be checked by the procedure outlined in Paragraph 6, and if trouble other than a defective tube is indicated, the instrument should be returned to AUTOMATED INDUSTRIAL ELECTRONICS CORPORATION.

c. If the seal on the instrument is broken without the permission of Measurements, the one-year guarantee will be void.

9. TUBE REPLACEMENT

a. To replace the 6AF4A tube, remove the tuning knob, remove the screw in the sealed cup washer at the center of the cover, remove the screws located on the right and left edges of the top cover and remove four screws holding the side. Do not disturb the two screws above the fiducial. Lift the cover off. Further disassembly is not recommended.

b. By trying a few 6AF4A's the tube best suited to match the original dial calibration can be found. Minor adjustments in the calibration may be made by loosening the two screws holding the fiducial and rotating it slightly.

10. RECOMMENDED EQUIPMENT

a. The only test equipment required is that which is necessary for checking frequency calibration. A Model 111 Crystal Calibrator for checking each 10 megacycles point is recommended.

CHAPTER 4

TECHNICAL SERVICE

11. SCOPE

The purpose of this chapter is to acquaint operating and maintenance personnel with the theory of operation of the various circuits in the Model 159 UHF Megacycle Meter.

12. CONDENSED THEORY OF OPERATION

a. V101 is connected in a Colpitts type oscillator circuit with the inter-electrode capacitance of the tube providing the feedback.

b. The oscillator is tuned by means of a split-stator type capacitor, C101 and C102.

c. L101 is the tank inductance formed by the loop in the plastic housing. The oscillator is coupled to external circuits to be tested by means of L101.

13. COUPLING

a. In general, the Model 159 UHF Megacycle Meter may be coupled to circuits using the same techniques as are employed with lower frequency grid dip oscillators. The coupling may be either inductive or capacitive, depending on the particular application.

b. For coupling at a low impedance point, inductive coupling is recommended (See Fig. 2a).

c. For coupling to a high impedance point, capacitive coupling is recommended (See Fig. 2b).

d. To obtain maximum inductive coupling, the orientation of the Model 159 UHF coil is important. The orientations for maximum and minimum inductive coupling in a typical case are illustrated in Fig. 3.

e. For high-Q circuits sufficient capacitive coupling may be obtained by bringing the high-impedance point of the circuit in close proximity to the Model 159 UHF coil. The best coupling position may be found by experiment.

f. The greatest frequency accuracy of the Model 159 UHF can be obtained by proper use of the instrument. In general, if the coupling to the circuit under test is too close, the oscillator will be detuned or "pulled". To obtain the greatest accuracy, couple the Model 159 UHF tightly to the circuit under test for the initial search of a dip in grid current or zero beat. After the initial indication is obtained, decrease the coupling as much as practicable while still obtaining an indication.

14. GRID-DIP METER PHENOMENA IN THE UHF BAND

a. Grid-Current Variation:

Some minor resonances or rapid grid current versus frequency variations may be noticed at a few discreet frequencies within the tuning range of the Model 159 UHF. These are due to internal resonances in the oscillator. Through careful design these resonances, or "suck-outs", have been minimized.

These spurious resonances are easily identified, since they are independent of the coupling distance to the circuit under test, while the depth of the desired resonances depends on the closeness of coupling to the measured circuit.

b. Optimum Coupling Distance:

In most cases it is desirable initially to couple very closely to the circuit under test. The plastic coil housing may be placed in direct contact with the circuit. After a resonance has been detected the coupling distance should be increased.

It is highly desirable that the Model 159 UHF and the test circuit be held in fixed positions with respect to each other, because at 900 megacycles, for example, a variation in coupling distance of 1.3 inches is one-tenth of a wave length. Slight relative movements, therefore, "swamp-out" grid current dips and make it extremely difficult to find a resonance.

It is desirable to tune very slowly in order not to overlook a sharp resonance. Many UHF circuits have a high Q and produce extremely sharp grid-current dips.

c. Dielectric Absorption:

Whenever possible, the circuit component under test should be kept away from glossy materials such as wooden or Masonite table tops, etc. These materials have high dielectric losses in the UHF band and will greatly reduce the Q of the circuit under test, or will load the grid-dip oscillator so heavily that resonances will not be distinguishable.

d. Radiation Phenomena:

Circuit elements to which the Model 159 UHF is coupled will often have dimensions which are a tenth of a wavelength, or longer,

at the measuring frequency. These elements will, therefore, behave like antennas and they will radiate appreciable energy. If the person using the grid-dip meter moves any part of his body just a slight amount, the waves reflected from his body will react back on the grid-dipper with a resultant variation of grid current. This natural phenomenon may be mistaken for erratic behavior of the instrument. (This phenomenon is the same as that which is utilized in the proximity fuse.) In order to prevent stray wave reflections from affecting the measurements, it is good practice to keep pieces of metal, instrument cases, etc., removed from the immediate measuring area.

A circuit element which behaves like an antenna and radiates an appreciable amount of electro-magnetic energy has an equivalent radiation resistance which reduces the Q of the element. Such an element will exhibit a broad, poorly-defined, resonance when coupled to a grid-dip meter.

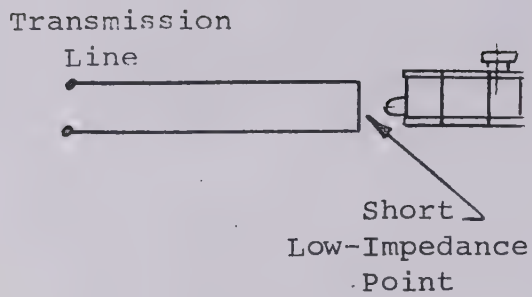


Fig. 2(a) Inductive Coupling

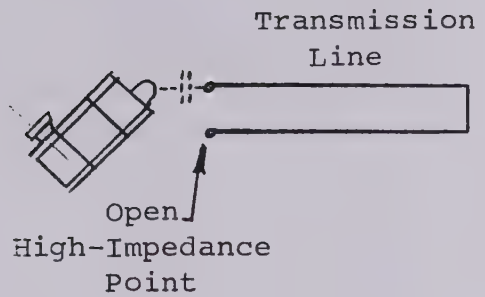
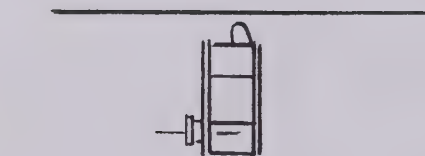


Fig. 2(b) Capacitive Coupling



Coil orientation for maximum inductive coupling

(a)



Coil orientation for minimum inductive coupling

(b)

Fig. 3 Inductive Coupling to a Length of Wire

APPENDIX I

1. STORAGE

a. Remove dust from controls and outer surface of instrument with a clean rag.

b. Wrap instrument in heavy wrapping paper and seal seams with gummed tape or similar adhesive.

c. Store in a dry place. If excessive humidity is unavoidable, the wrapped instrument should be placed in a moisture-proof bag with a sufficient quantity of drying agent, such as silica gel, to insure a dry atmosphere.

1. When the use of bag and desiccant is necessary, the instrument should be checked at 6-month intervals to determine the effectiveness of the seal.

2. SHIPMENT

a. Wrap the instrument with heavy wrapping paper and seal seams with gummed tape or similar adhesive.

b. Place in fibre-board carton or wooden box large enough to permit at least 3 inches of excelsior or similar packing material between the instrument and sides of the box.

1. For export packing, the instrument must be wrapped in waterproof paper and the seams sealed with glue or similar sealing compound before being placed in a wooden box.

APPENDIX II

TABLE OF PARTS MODEL 159 UHF

<u>Symbol</u>	<u>Measurements Part Number</u>	<u>Description</u>
<u>Capacitors</u>		
C101	*	Variable Part of Meas. H-4614
C102	*	Variable Part of Meas. H-4614
C103	*	Fixed; 13 mmf. Part of Meas. H-4614
C104	*	Fixed; 13 mmf. Part of Meas. H-4614
C105	H-5372	Fixed; ceramic 4.7 mmf 10%; 500 WVDC
C106	H-6473	Fixed; ceramic 1000 mmf GMV
C107	H-6473	Fixed; ceramic 1000 mmf GMV
C108	H-6473	Fixed; ceramic 1000 mmf GMV
<u>Knob</u>		
E101	H-7740-5	Round
<u>Foot</u>		
H1	H-5507	Rubber
<u>Coils</u>		
L101	*	Loop Part of Meas. H-4635
L102	H-4639	Coil; rf; choke
L103	H-4636	Coil; rf; choke; 15 turns
L104	H-4636	Coil; rf; choke; 15 turns
L105	H-4638	Coil; rf; choke; 10 turns
<u>Connector</u>		
P101	H-7744	Plug; male 6 prong
<u>Resistor</u>		
R101	H-3734-471	Fixed; composition; 470 ohms 10%; 2W
R102	H-4728-153	Fixed; composition; 15K ohms 10%; 1/2W
R103	H-4728-333	Fixed; composition; 33K ohms 10%; 1/2W

* Not recommended for field replacement.

<u>Symbol</u>	<u>Measurements</u> <u>Part Number</u>	<u>Description</u>
<u>Tube</u>		
V101		Electron; triode; 6AF4A.
<u>Cable</u>		
W101	H-886	Flexible; 5 conductor
	H-7705	Flexible; 5 conductor. Included P101.
<u>Socket</u>		
XV101	*	Tube. Part of Meas. H-4614.

* Not recommended for field replacement.

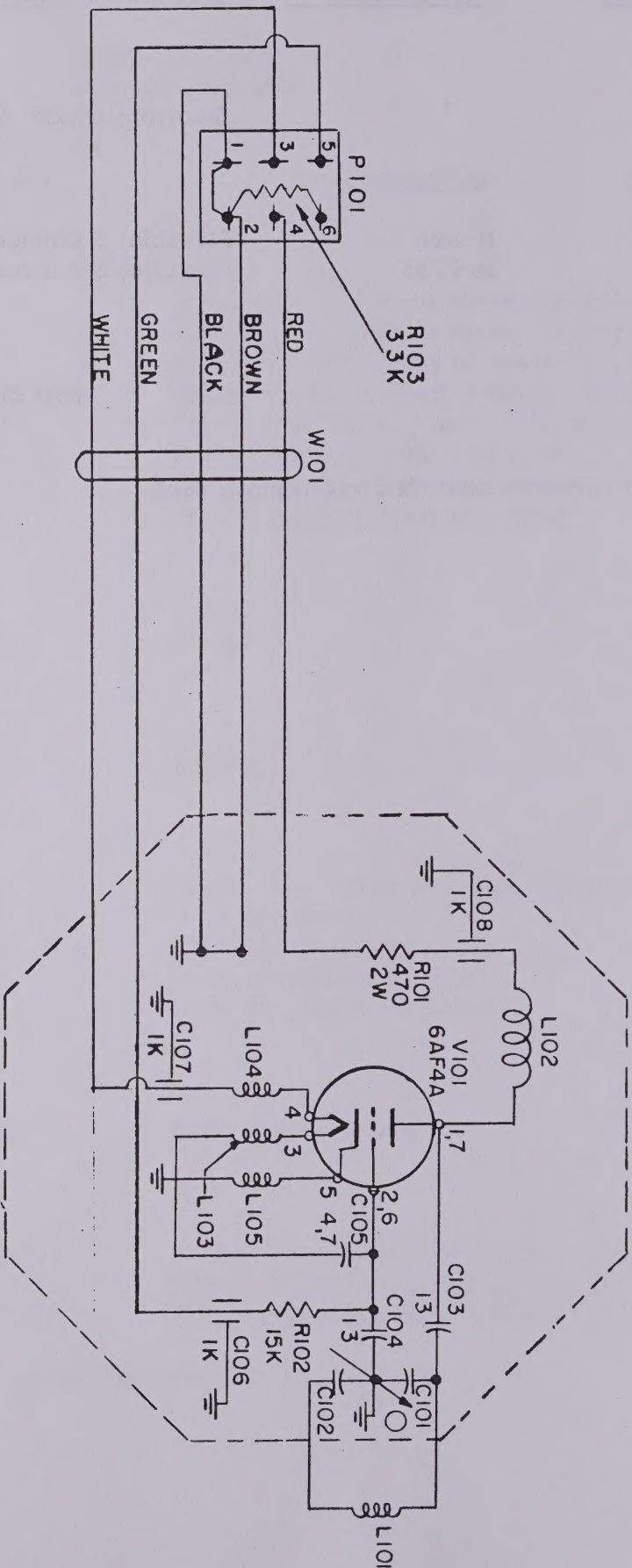
CONNECTOR VIEWED FROM SOLDERING TERM. END.

SCHEMATIC DIAGRAM MODEL 159 UHF

UNLESS OTHERWISE SPECIFIED

ALL RESISTORS 0.5 WATT,
ALL CAPACITORS IN MMF.

○ = FRONT PANEL CONTROL



MP MASTER



MA24299